science was the best friend any worker could call to his aid, whatsoever might be his particular part and calling in labour. Sir Alfred Jones submitted the toast of "Commerce and Scientific Research," replied to by Sir Michael Foster and Prof. Armstrong. To the toast of "Our Foreign Guests," Prof. Ravanel (Philadelphia), Prof. Nocard (Paris), Prof. Weigert (Frankfort), and Prof. Perroncito (Turin) replied.

THE IRON AND STEEL INSTITUTE.

THE annual meeting of the Iron and Steel Institute was held at the Institution of Civil Engineers on May 7 and 8, and was very largely attended.

The report of the council, read by Mr. Bennett H. Brough, the secretary, showed that in 1902 the Institute had made very satisfactory progress. The membership amounted to 1692, and it was announced that the Institute had subscribed 1000*l.*, payable in five yearly instalments, to the funds of the National Physical Laboratory.

After the usual routine business, the retiring president, Mr. William Whitwell, inducted into the chair the president-elect, Mr. Andrew Carnegie. The first duty of the new president was to present the Bessemer gold medal to Sir James Kitson, which he did in felicitous terms. He then handed the Andrew Carnegie gold medal to Mr. A. Campion for his research on the heat treatment of steel, and a special silver medal to Dr. O. Boudouard, of Paris, for his research on the determination of the points of allotropic change of iron and its alloy. The research submitted by Mr. P. Longmuir, of Sheffield, on the influence of varying casting temperature on the properties of alloys was commended, and a further grant of 50*l.* was made to him to complete the work. Mr. Campion also received a further grant of a like amount to enable him to carry his researches further.

For the scholarships for the current year a large number of applications was received, and after very careful investigation of the claims, the council decided to award four scholarships of 100*l.*, each tenable for one year, to C. O. Bannister (London), to P. Breuil (Paris), to K. A. Gunnar Dillner in conjunction with A. F. Enström (Stockholm), and to J. C. Gardner (Middlesbrough), respectively.

Mr. Carnegie then delivered his inaugural address. It differed widely from all that have preceded it in that it dealt not with metallurgical technology, but with a consideration of the best and most economical methods of obtaining harmonious working between the mechanical and business departments of a concern, and of securing hearty cooperation between the employers and the employed. The address was much appreciated, and the thanks of the Institute were eloquently expressed by Sir Bernhard Samuelson and Sir David Dale.

The first paper read was by Mr. B. Talbot, of Leeds, who described the development of the continuous open-hearth process. Since this new departure in metallurgy was first described in 1900, considerable progress has been made, and a furnace of 200 tons has been in successful operation for some months at Pittsburg. Other furnaces of nearly the same capacity are being erected in Great Britain, in France, and in the United States. In the lengthy discussion that followed, Mr. E. H. Martin, of Pittsburg, adversely criticised the paper, whilst Mr. P. C. Gilchrist, Mr. E. Riley, Mr. Saniter, Mr. F. W. Paul, Mr. G. Ainsworth, Mr. Harbord, and Mr. T. H. Colley spoke in favourable terms of the process.

The meeting then adjourned until May 8, when Mr. Camille Mercader gave an account of the development in the manufacture of railway axles on a large scale accomplished at the works of the Carnegie Steel Company at Pittsburg. With the aid of numerous illustrations, he described a method of producing, by pressing, hollow axles having varying diameters. An animated discussion followed, in which Mr. R. M. Daelen and Prof. Bauerman expressed the opinion that the invention had been anticipated by Ehrhard, of Düsseldorf. Sir James Kitson, Mr. E. Windsor Richards, Mr. S. Lloyd, and Mr. Vaughan Hughes also took part in the discussion.

Prof. J. O. Arnold and Mr. G. B. Waterhouse, of Sheffield, then read an important paper on the influence of sulphur and manganese on steel. The steels examined were those experimented upon by Mr. Brinell. The results of the authors' investigations show that sulphide of iron is deadly in its effect upon steel, whilst sulphide of manganese is comparatively harmless; that the above facts are due to the fusibility, the high contraction coefficient, and the tendency of sulphide of iron to form cell walls or enveloping membranes surrounding cells of ferrite, whilst sulphide of manganese is much less fusible, segregates whilst the iron is at a high temperature, and so collects into rough globules, and very seldom into meshes; that manganese retards the segregation of iron and hardenite, and that what is called pearlite in a normally cooled manganese steel is really a mixture of granular pearlite and unsegregated ferrite; and that the complete segregation of the ferrite in a manganiferous steel can be brought about by very slow cooling, but that such annealing injures the mechanical properties of the steel by lowering the maximum stress and the reduction of area per cent. registered by the unannealed steel. An interesting discussion followed, in which Mr. Stead, Mr. F. W. Harbord, Mr. Vaughan Hughes, and Mr. Sidney Houghton took part.

The next paper read was by Mr. A. Keller, of Paris, who described the application of the electric furnace in metallurgy. This furnace, which is apt to be regarded merely as a laboratory appliance, will, the author thinks, find a place in the iron industry on a large scale. He shows that, although the manufacture of alloys which are little used can scarcely entitle it to rank as a metallurgical appliance, the production of ferrosilicon, which is one of the bases of modern metallurgy, and of iron, steel, copper, and nickel, will permit it to be regarded in this light. The success is the result of carefully controlled operations on a large scale at Livet, in the department of Isère. In the discussion, Mr. A. H. Allen, Prof. Arnold, Mr. B. H. Thwaite, Mr. A. Greiner, Mr. Stead, and Mr. Kilburn Scott bore testimony to the value of the invention.

Mr. C. von Schwarz, of Liége, described the best methods for making Portland cement from blast furnace slag, and showed that there is a wide field open to English blast furnace works for carrying on a profitable industry by the utilisation of their principal by-product. In the discussion Mr. Hutchinson described at considerable length the results obtained at Middlesbrough, and Mr. Stead spoke in optimistic terms of the future development of the manufacture.

Mr. Axel Sahlin next described an ingenious blast furnace top designed not to admit air or to permit gas to escape. Although the blast furnace top has been greatly modified and improved of late years in order to enable the furnace gases to be utilised, it still possesses certain defects which occasionally lead to explosions and other hindrances to efficient working. These drawbacks have been remedied in the blast furnace top described. The construction of this furnace top and its adjuncts ensures immunity from explosions, as no air can enter the furnace at the top, whilst it also provides against gas leaks and accumulations of dust. The success of the new top is demonstrated by its adoption at the Iroquois Iron Works, near Chicago, where the first one was started in 1901, and where fourteen are now working.

Mr. B. H. Thwaite then read a paper on the detrimental effect of flue dust upon the thermal efficiency of hot-blast stoves.

Colonel Cubillo, of Trubia, Spain, submitted an elaborate paper on the open-hearth process, in which he gave calculations of the heat balance of the furnace. The experiments on which the paper was based were carried out in a four-ton Siemens furnace of the new form.

Mr. J. E. Stead submitted a note on the alleged cementation of iron by silicon announced by Moissan and Lebeau. Mr. Stead's experiments show that at temperatures between 1100° and 1200° C. solid iron and free silicon do not combine, and that cementation by silicon is impossible when the iron and steel operated upon are in solid masses.

Prof. Thomas Turner, of Birmingham, submitted an analysis of a specimen of Sussex iron, some 200 years old. The results were as follows:—graphitic carbon, 2·89; combined carbon, 0·32; silicon, 0·62; sulphur, 0·08; phos-

phorus, 0·56; manganese, 0·77; and iron (by difference), 94·76.

The memoirs submitted by the Carnegie research scholars were taken as read, and are open to discussion by correspondence. The paper by Mr. A. Campion, for which the gold medal was awarded, covers seventy-five pages, and is illustrated by fifteen plates. It deals with the heat treatment of steel under conditions of steelworks' practice. The paper by Dr. O. Boudouard, of Paris, for which a special silver medal was awarded, covers eighty pages, and deals with the determination of the points of allotropic change of iron and its alloys by the measurement of the variations in the electric resistance. Results are given for carbon steels, chrome steels, tungsten steels, manganese steels, and nickel steels. The remaining memoirs presented by the Carnegie research scholars deal with the influence of varying casting temperature on the properties of alloys, by Mr. P. Longmuir, of Sheffield, and with the manufacture of tool steel, by Mr. E. Schott, of Berlin.

The proceedings concluded with the usual votes of thanks to the Institution of Civil Engineers, proposed by the president and seconded by Prof. Gowland, and to the president for his conduct in the chair, proposed by Prof. Syed Ali Bilgrami and seconded by Mr. F. Samuelson.

In the evening Mr. Carnegie presided at the annual dinner, which was attended by about six hundred members. The Prime Minister congratulated the Institute on its international and scientific character, and speeches were made by the Duke of Devonshire, Sir H. Campbell-Bannerman, Mr. John Morley, Viscount Ridley, Sir Henry Fowler, Sir James Kitson, and Sir Samuel Chisholm.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The 248th meeting of the Junior Scientific Club was held on Friday, May 8. Mr. R. T. Günther read a paper on "Changes of Land Level," in which he gave an account of researches he had carried out on this subject in the neighbourhood of Naples. The paper was illustrated by slides showing photographs of the coast in this district. Mr. N. V. Sidgwick, Lincoln, read a paper on "The Emission of Heat by Radium Salts."

CAMBRIDGE.—The council of the Senate propose that the Hartley University College, Southampton, should be adopted as an institution affiliated to the University of Cambridge.

The syndicate on the Mathematical Pass Examinations have issued an important report (*University Reporter*, May 12, 1903), in which they recommend a number of far-reaching changes in respect to the geometry, arithmetic, and algebra required in the previous examination. They "are of opinion that it is no longer desirable to insist on the maintenance of Euclid's Elements as a text-book."

The Board of Agricultural Studies report that during the past year 169 students have received instruction in agricultural science in connection with the department. The income of the department, about 3700*l*., is practically balanced by the expenditure. The need of a permanent building to accommodate the various branches of the work is becoming apparent, and the Board are considering how the need can be supplied.

Dr. Ruhemann, university lecturer in organic chemistry, has been appointed the university delegate to the Congress of Applied Chemistry to be held next month in Berlin.

A bust of the late Dr. John Hopkinson was unveiled at the engineering laboratory on Monday. The vice-chancellor presided, and the speakers included Sir Joseph Lawrence, M.P., Lord Kelvin, Prof. Ewing, and Principal Hopkinson.

DR. CHARLES CHILTON has been offered and has accepted the professorship of biology at Canterbury College, Christchurch, New Zealand, in succession to Prof. Dendy.

THE *Pioneer Mail* states that the site assigned to British India by the Mysore Government for the Indian University of Research to be created in consequence of Mr. J. N. Tata's munificent offer of an endowment measures about 370 acres, is situated in the north-west of Bangalore Cantonment, about four miles beyond the municipal boundary. Besides this gift the Mysore Government have offered five lakhs for initial expenses, and they hold out hopes of further assistance. Prof. Masson and Colonel Clibborn calculate the annual expenditure at 10,000*l*. sterling.

BOOTHAM SCHOOL, at York, was one of the few schools which received medals at the Nature-Study Exhibition last year for their exhibits showing the extent and nature of the work in nature-study done by the pupils. The sixty-ninth annual report of the Natural History Society of this school serves to explain the success then achieved. The study of natural objects is continued throughout the year, and is carefully arranged by the science masters so as to avoid waste of time and effort. A boy with a love for any branch of natural history receives every encouragement, and there can be little doubt of the good effect this sympathetic treatment has on the education imparted.

THE fiftieth report of the Charity Commissioners for England and Wales shows that in the three years ending December 31, 1901, the total amount of charitable bequests in England and Wales reached 6,542,110*l*., of which 279,890*l*. was intended for education. It has often been pointed out in these columns what large sums are given to higher education in the United States. During the three years dealt with by the Charity Commissioners in their report, benefactions for higher education alone to the extent of 10,392,000*l*. were reported in the United States. That is to say, for every pound sterling given during 1899–1901 for education in all its grades in England and Wales, more than thirty-seven pounds were given by American benefactors for university education alone. The sums devoted by private persons to higher education in the United States were nearly twice as great during these three years as those for every form of charity in England and Wales.

NUMEROUS changes in the regulations for examinations at the University of Oxford have recently been announced. Among the alterations are those in mathematics for the first public examination (pass), in connection with which it is stated that any method of proof will be accepted which shows clearness and accuracy in geometrical reasoning, and that in the case of propositions 1–7, 9, 10 of Book ii., algebraical proofs may be used. The Board of the Faculty of Natural Science has also made similar changes in the mathematical requirements of the Final Pass School, Group C. (1). These changes come into force at the examinations of Michaelmas term, 1904. There are additions to the schedule of mechanics and physics for the preliminary examination of the Honour School of Natural Science, which come into force on and after Trinity term, 1905. The practical examinations, especially in physics, are to be more extensive than hitherto.

A COPY of the report and handbook for the session 1902 of the Technical Instruction Committee of the Essex County Council has been received. It contains detailed information of every department of the work of the committee, and provides another example of the thorough manner in which the county councils have performed the educational duties entrusted to them by the Technical Instruction Acts, now repealed. In connection with the agricultural instruction in Essex, field meetings were held at seven centres. The objects of some of the meetings were to demonstrate the destruction of charlock in field crops by spraying with solutions of copper sulphate and nitrate of soda; the improvement of derelict grass land by manures; no verbal description could adequately convey an idea of the improvement effected by basic slag, which was one of the manures used, on either of these fields, and the farmers attending were strongly impressed by the almost miraculous effect of this manure both on the quality and quantity of the herbage.

THE annual exhibition of the work of pupils in the day, evening continuation, truant, blind, deaf, and special instruction schools of the London School Board was opened last Saturday by Lord Reay at the Examination Hall, Thames Embankment. The exhibits were very numerous and thoroughly representative of the work of children of